PT656
National IPM program for potato pests

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Know-how for Horticulture™

PT656

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Industry Summary

Information on Integrated Pest Management was provided to potato growers, crop advisors and others in the industry around Australia by demonstrating it in action. The intention was to demonstrate that the information developed in previous HRDC funded and other projects could be put into practice, and to demonstrate exactly how this could be done.

The most important component of this IPM strategy is that monitoring is undertaken regularly. This can be done by growers if they are confident of identifying pests and beneficial species, and some growers are already doing this. However, as outlined in the article by Peter O'Sullivan in "Eyes on Potatoes", many growers will only adopt IPM when support in the form of trained crop monitors are available for them to use.

Crops were monitored in districts where trained crop scouts were available. These crops provided the local information to demonstrate that using IPM meant equal or better yields, and equal or better quality at lower cost with better pest control. Two growers using IPM in different parts of the country (Atherton, Qld. and Ballarat, Vic) have won awards for their crops from the processors that they supply. Support from the growers who owned the monitored crops was important in showing that IPM was practical and could be used immediately to produce good crops without total reliance on insecticides.

Information based on these demonstration crops was presented at grower meetings, field days, industry meetings, conferences and workshops and in written articles.

Technical Summary

Information on the components of an Integrated Pest Management strategy has been developed with support from HRDC funding over several years. In this project, information on IPM was provided to potato growers, crop advisors and others in the industry around Australia by demonstrating it in action. The intention was to demonstrate the protocol for monitoring insects in potato crops, and how to utilise the information that it developed to give effective control of pests. That is, this project demonstrated IPM in practice.

The most important component of this IPM strategy is that monitoring is undertaken regularly so that decisions on action to be taken against specific pests can then be made with precision. Monitoring can be done by growers if they are confident of identifying pests and beneficial species, but many growers will only adopt IPM when support in the form of trained crop monitors are available for them to use. The crop monitoring effectively reduces the perceived risk of insect damage that growers would have otherwise responded to with foliar applications of broad-spectrum insecticides.

Crops were monitored in districts where trained crop scouts were available. These crops provided the local information to demonstrate that using IPM meant equal or better yields, and equal or better quality at lower cost with better pest control. Two growers using IPM in different parts of the country (Atherton, Qld. and Ballarat, Vic) have won awards for their crops from the processors that they supply. Support from the growers who owned the monitored crops was important in showing that IPM was practical and could be used immediately to provide good results.

Information based on these demonstration crops was presented at grower meetings, field days, industry meetings, conferences and workshops and in written articles.

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Introduction

This project was conducted with the main aim of taking the information on IPM in potatoes that had been developed over several years and demonstrating it in action to potato growers and crop advisors across Australia. This was to be achieved by conducting intensive monitoring of commercial crops where trained crop scouts existed, and by demonstrating the process to growers and crop advisors in other areas.

IPM strategies have been developed for potato crops overseas (Rowe 1993), but these deal with different pest complexes including, in many cases, Colorado potato beetle (*Leptinotarsa decemlineata*). Strategies exist for crops grown in western USA, Wyoming, Idaho, and British Columbia in Canada, but these are necessarily different to Australian requirements, not only because of different insect species but also because of differing production methods and climates Only one of the four most important insect pests (aphids) occurring in the USA (in Pimentel *et al* 1997) is a problem in Australia.

Adoption of IPM has been shown to give tangible benefits, both economic and environmental, in a range of horticultural and field crops (National Research Council 1989). In USA potato crops it has been estimated (in Pimentel *et al* 1997) that insecticide use could be reduced by 75% with effective crop monitoring. In many cases, there are long-term benefits of reducing insecticide applications through adoption of IPM; for example, reducing the risks of insecticide resistance in pests. However, there are also cases where benefits are achieved almost immediately; for example, reduced costs through fewer insecticide applications. No data are available for Australian crops, but it has been

estimated (Pimentel and Greiner 1997) that losses due to the destruction of beneficial insects with insecticide applications in US potato crops amounts to $8 million per annum.

Despite the benefits of IPM, overseas experience has shown that adoption of IPM by farming industries can be very slow, particularly in the USA (Herbert 1995). In contrast, adoption of IPM by Australian potato growers has been very rapid. The crisping potato sector (in Australia) was found to have the highest level of adoption, because of grower groups and dedicated advisors.

The highest levels of adoption were found to have occurred where information on IPM has been presented to growers, in person, by someone with whom they have regular contact. We attributed this to work by individuals that growers respect and who they saw on a regular basis. Some of their work is reported in potato industry literature (Hall, 1995; Lanz 1994; Strange 1994)

In Australia, previous survey work by Paul Horne (HRDC project 437, Horne and Rae 1995) had shown that the level of awareness of IPM could be raised (and indeed had been raised) by talks and printed material, but adoption of IPM was much greater when information on IPM was given first-hand. The person giving the information could be a crop advisor, another grower or government officer, but needed to be someone the grower trusted and saw regularly.

There were extremely few crop advisors, either within government or in private industry, working in potato crops that visited crops and gave advice on insects to growers on a weekly basis. Those few that did do such work did not usually take into account the role of beneficial insects (predators and parasites). Therefore, it was necessary to explain (and

demonstrate) to both growers and their advisors just how IPM worked in practice, not just in theory.

This project therefore aimed to prove to growers and crop advisors that an IPM approach was cost-effective, eliminated unnecessary insecticide applications and produced yields equal to or better than crops grown under conventional pest-management systems.

Biological control is a large component of IPM in potatoes (Horne 1990a, 199b) and we knew from previous work that one key beneficial species of wasp (*Orgilus lepidus*) that parasitises potato moth, was absent from Western Australia. Therefore, this project also included a component of releasing this species in potato crops in WA.

Methods

A small number of growers (4-10) in key districts co-operated with the field demonstrations during the 1996-97 season. Their crops were monitored weekly and the growers were given information on pests and beneficial insects in their crops. With this information, for the first time in most cases, growers were able to make informed decisions on what was the risk of insect damage and what was the appropriate action to take.

In Victoria, crops were monitored in the Thorpdale, KooWeeRup and Ballarat districts. It was a very hot and dry growing season which meant that potato moth in particular was a severe problem. From the perspective of this demonstration, it was an ideal year in which to demonstrate IPM, as if it could work in this year it would work at any time. Therefore, growers were more likely to take notice of results from this particular season than any other for many years.

To prove that the IPM approach was suited to growers in all sectors of the industry, crops were chosen to cover the following types: That is, monitoring was carried out in (i) certified seed crops, (ii) crisping potato crops, (iii) processing potato crops, (iv) fresh market potato crops and (v) certified organic crops.

Another aim, in Victoria and in other states, was to train crop advisors already working in potatoes, and also raise awareness of IPM amongst growers. These two factors together would make adoption of IPM by growers possible for the first time. Monitoring can be done by anyone, including the grower, who is confident that they can identify the pest and beneficial species and has the time to conduct the regular monitoring. In practice, IPM is usually only adopted if the growers have support in this regard from crop scouts.

A separate project in NSW involving Sandra Lanz and Robert Spooner-Hart was already using most of the principles involved in this project (local advisor, first-hand information and monitoring pest and beneficial insects). In this case, the augmentative releases of *Orgilus* wasps was the factor that was promoted. The wasps were reared by IPM Technologies and distributed to field sites.

In Western Australia, the releases of wasps were used as the focus for grower meetings and farm walks.

Many talks, mainly to grower and potato industry groups but also to scientific audiences were given during the year. These talks were to continue to raise awareness and interest in IPM by growers and others, and at the same time to explain how the monitoring could be done.

In May 1997, a protocol for monitoring potato crops in Australia was developed by bringing together most of the people in this project who were involved in advising growers. The aim was to develop a basic monitoring procedure that could be used in any crop in Australia. It was not intended to be the final protocol for every area but the basis on which to begin in any area with confidence. In particular, it is a way in which the role of beneficial species is taken into account.

Results

Monitoring in Victoria was very successful, with insecticide use being considerably reduced, and crops producing yields as high or greater than usual. Support from growers as a result of these trials was very high and selected grower responses were given in an article in "Good Fruit and Vegetables" magazine (June 1997). The text of this article is attached here, as it summarises much of the effort that has gone into IPM in potatoes through this project. Another article showing the level of success of this work in Victoria is the one by Peter O'Sullivan in "Eyes on Potatoes" (December 1997).

Good Fruit and Vegetables magazine (June 1997).

Integrated Pest Management in Potato Crops

This year groups of potato farmers in different districts around the country have been carrying out full trials of Integrated Pest Management (IPM). In Victoria in particular, where it has been a very hot dry season, pest pressure has been high and so IPM has been given a thorough test.

The aim of these trials, which are being funded by HRDC, is to demonstrate that recent research into insect pest control has yielded information that is of immediate value to potato growers. Growers using the IPM strategy have found that it resulted in significant savings by reducing the number of insecticide sprays, without any loss of production or quality.

Peter O'Sullivan; KooWeeRup, Crisping potato grower:

"Using IPM has saved us thousands of dollars this season and we have not had any loss of yield or quality."

David Graham; Thorpdale, Certified Seed potato grower:

"Monitoring our crop for pests has saved us from applying unnecessary insecticides, especially for control of aphids"

Barry Scobie; Ballarat district, Processing potato grower;

"Monitoring and IPM reduced our costs for pest control, and even in this hot, dry season we had no serious insect damage."

George Serra, Atherton Tableland, Crisping potato grower

"Using IPM we are growing some of the best quality potatoes in Australia and have saved thousands of dollars by cutting out unnecessary insecticide sprays."

The main difference between the IPM approach and conventional control is that IPM uses all available control measures, including biological and cultural (management) controls. IPM uses chemicals as an added control, not the sole control. Much of the information has been developed through research by Dr Paul Horne and his co-workers (again funded largely by HRDC) over several years. He established the company IPM Technologies in order to demonstrate the benefits and effectiveness of IPM by using intensive monitoring to groups of potato growers. Commercial potato crops that are being monitored in many production districts are therefore the focus where many growers can evaluate the performance of IPM.

Monitoring is a key component of the IPM strategy. This season Dr Paul Horne and Cindy Edward of IPM Technologies P/L have been monitoring crops weekly at the demonstration sites in Victoria. They monitor all pests and also monitor the numbers of beneficial insects and spiders in the crops. That is, aphids, potato moths, loopers, Rutherglen bugs, mirid bugs and thrips etc. are counted each week, but so are the numbers of predators (lacewings, ladybirds, spiders, damsel bugs etc) and parasites. **Any decisions on control measures are therefore based on up to date information from the growers own crop.** Obviously, this approach depends entirely on regular contact between the crop monitors and the grower. This strategy makes the best use of insecticides through accurate timing of appropriate chemicals and avoids unnecessary insecticide applications.

Crops in South Australia, NSW, and Queensland are being monitored and the IPM approach is being demonstrated in the same manner as the Victorian crops. The techniques for monitoring pest and beneficial insects and making decisions based on the findings from each crop are being used and also assessed. The IPM strategy is adapted to suit local conditions and production methods. For example, fewer insecticides are being used on monitored crops grown under centre pivots near Swan Hill, despite higher numbers of pests, than on many crops in cooler, traditional potato growing districts.

Tony Kourmouzis, Crop Monitoring; Swan Hill.

"Pest numbers on centre-pivot grown crops can be very high compared with crops grown in southern Victoria, but the combination of biological controls and good soil and irrigation management means very few or no insecticides are required."

Biological control agents in potato crops include both predators and parasites. One key parasite, called *Orgilus lepidus* is being reared by IPM Technologies and released to kill potato moth. This wasp already occurs in most potato districts, except in WA and in Ballarat. New release methods developed this year mean that the usual delay in establishing biological control agents can be avoided. That is, releases of this wasp into potato crops will result in more parasites early, and less potato moth during the life of the crop. Trial releases have been carried out in Ballarat, KooWeeRup (Vic), Atherton (Qld) and Manjimup (WA). The results have been good and these mass-reared wasps are now available to growers.

Rod May; Ballarat district; Organic potato grower:

"Both organic and conventional potato growers can take advantage of biological control agents such as the *Orgilus* wasps in their normal crop production."

One important difference with the use of IPM is that the aim is to manage pests not eradicate them. The regular monitoring of crops has shown that pest resurgence following insecticide application can result in greater numbers of pests than in unsprayed crops. Contrary to what most growers would assume, the use of broad spectrum insecticides does not always result in fewer pests.

Using an IPM approach Australian growers are producing potatoes with fewer insecticide applications than most other countries, particularly those countries with Colorado potato beetle. IPM for Australian potato crops has a sound scientific basis and growers in different districts and producing for different sectors of the market have evaluated its performance positively.

Contact:
Dr. Paul Horne, IPM Technologies Pty Ltd, PO Box 560, Hurstbridge Vic. 3099.

In other states, the response has been similarly encouraging, with growers, processors, government departments and crop advisors all wanting to begin using IPM. Monitoring of potato crops with the approach developed in this project has commenced in WA (Simplot and AgWA, Stewart Learmonth), in South Australia (PISA, Ben Dowling; SAFRIES; and Murray Bridge area), and in Queensland (Atherton Tableland). Augmentative releases of *Orgilus* wasps has commenced in NSW (via Robert Spooner-Hart), Queensland, Victoria and Western Australia.

It had been intended that *Orgilus* wasps be produced by Bugs for Bugs P/L in Queensland, but difficulties with establishing a viable colony there meant that was not

possible. Instead, a new colony was established by IPM Technologies P/L and this was used to supply WA and other trial sites.

A list of articles written on IPM, and groups addressed as a result of this project, is listed below.

Grower Meetings and Field Days

Crisping Potato Research Group Meeting, Knoxfield, December 1996

Potato Crisping Research Group Farm Walk, Cora Lynn, Vic. December 1996

SA Crop advisors, Murray Bridge, SA., December 1996

Portland Potato Growers, February 1997

Thorpdale Seed Growers Meeting, February 1997

Field Walks with McCains growers, Ballarat district, February 1997

AgVic Field Days at Ballarat and Colac, February 1997

Potato Growers Meetings, Atherton Qld., April 1997

Potato Growers Meetings (3), WA: Manjimup, Busselton and Bunbury, June 3-5, 1997

Fresh Market Potato Workshop, Knoxfield, June 1997

Potato Industry Technology Transfer Day, Coonawarra, September 1997

Potato IPM Field Day, Waikerie, SA, October 1997

Industry literature

Seed Potato Quarterly, January 1997 *Pest Management in Potatoes.* Paul A. Horne

McCains Tater Topics, February 1997 *Pest Management in Potatoes.* Paul A. Horne

Good Fruit and Vegetables, June 1997: *Integrated Pest Management in Potato Crops*

Potato Australia, September 1997. *IPM in Action.* Paul Horne

Organic Potato Growers Newsletter *Pest Management in Potatoes.* Paul A. Horne

Eyes on Potatoes, December 1997. *A farmers view of IPM.* Peter O'Sullivan

Scientific and Industry Conferences and Workshops

VegTec 2000, Brisbane 1996: Integrated Pest Management in Potatoes - *A new approach to potato pest control.* Paul A. Horne

NZ & Australian Entomological Societies Conference, Christchurch 1996: *Development and adoption of an IPM strategy for potato crops.* Paul A. Horne, C.L. Edward and J. Rae.

National Crisping Potato Workshop, Toowoomba July 1997: *IPM -Where is it at?* P.A. Horne

Seed Potato Industry Workshop and VICSPA AGM, Wallace, September 1996: *Integrated Pest Management.* Paul. Horne

Australian Entomological Society Conference, Melbourne, 1997. *Successful IPM - Research to Adoption.* Paul A. Horne, Janet A. Horne and Cindy L. Edward

Discussion

The most important component of this IPM strategy is that monitoring is undertaken regularly. It has been estimated (Pimentel 1997) that in potato crops in the USA, insecticide costs can be reduced by 75% simply by using effective crop monitoring. Our results in this project suggest that savings of more than 75% could be regularly achieved by monitoring crops effectively. This monitoring can be done by growers if they are confident of identifying pests and beneficial species, and some growers are already doing this. However, as outlined in the article by Peter O'Sullivan in *Eyes on Potatoes*, many growers will only adopt IPM when support in the form of trained crop monitors are available for them to use.

A direct outcome of this project is that growers want to use IPM and crop advisors are able to use the protocol outlined in Appendix 1.

In Victoria, IPM Technologies , McCains field staff and private consultants are now operating with the IPM protocol to serve growers in many districts. Regular information on the district's insect situation is provided through a fax-out information service, "Spudline", run by Tony Myers and the Potato Crisping Research Group.

In northern Victoria and southern NSW (Swan-Hill-Robinvale area), crops are being monitored in an IPM framework.

In WA, following the series of talks and farm walks carried out through this project, Simplot and AgWA are monitoring potato crops in an IPM strategy for the first time. Further releases of *Orgilus* wasps are planned.

In NSW, growers are adding releases of *Orgilus* wasps into their existing IPM strategy.

In South Australia, crop advisors and growers in the SE (with Safries and PISA), Murray Bridge, and Waikerie, are using IPM.

In Queensland (Atherton), grower groups originally organised by Jim Gunton (QDPI) are using IPM, including monitoring by scouts and releases of *Orgilus* wasps.

We suggest that, where growers are using IPM, then at the same time information on aphids, thrips and viruses in particular should be gathered in all major production districts. This will allow significant developments to be made in the use of action thresholds. That is, growers will obtain information on how many pests can be tolerated in different districts. Insecticide applications could be reduced further if we knew exactly what was the background district risk of the presence of virus-infected aphids and thrips.

The adoption of IPM in Australia is resulting in a "cleaner" product. That is, a crop of high quality grown with minimal insecticide (often no insecticide) use. On a world market this is certainly a commercial advantage.

From the grower's point of view, fewer applications of insecticides (often none) means less time and money spent spraying, and far less hazard for the person who would formerly apply many sprays. It has also been noted by growers that they achieve a better yield when using IPM because of the increased time spent monitoring each crop.

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Herbert, D.A. (1995) Integrated pest management systems: Back to basics to overcome adoption obstacles. J. Agric. Entomol. **12**(4) 203-210.

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Rowe, R.C. (1993) Potato Health Management APS Press

Strange, P. (1994) A wholistic approach to growing crisping potatoes. Potato Australia 5:15-15.

Appendix 1: Summary of the IPM in Potatoes Meeting, May 1997

This meeting was held at Melbourne Airport Travel Lodge to allow those involved in the IPM in Potatoes project to talk directly to each other about their field experiences of IPM. The aim was to improve awareness of how IPM was progressing around Australia, and to increase contact between the people conducting IPM monitoring.

A list of those attending, plus those involved in the project but not able to attend the meeting, with contact numbers is provided here.

Paul Horne	IPM Technologies P/L, Vic	ph:	03 97101 554
Cindy Edward	IPM Technologies P/L, Vic	fax:	03 97101 354
Andrew Henderson	AgVic, IHD, Knoxfield, Vic.	ph:	03 9210 9222
		fax:	03 9800 3521
Keith Lewis	Biotechnical Field Services, Atherton, Qld	ph:	070 912 460
		fax:	070 913 506
John Hall	Crop Tech Research, Bundaberg, Qld	ph:	071 55 6344
		fax:	071 55 6656
Rod Lay	McCains, Ballarat, Vic	ph:	0353 392 241
David Ryan	McCains, Ballarat, Vic	fax:	0353 381 150
Paul Frost	Safries P/L, SA	ph:	08 8737 2372
		fax:	08 8737 2858
Trevor Twigden	Horticare P/L, Murray Bridge, SA	ph:	08 8532 5677
		fax:	08 8532 2011
Ken Morley	Solan P/L, Waikerie, SA	ph:	085 41 2802
		fax:	085 41 3108

Neil Hives	Ballarat University, Vic.	ph: fax:	0353 279 216 0353 279 240
Tony Kourmouzis	Irrigation and Crop Monitoring Service, Swan Hill, Vic.	ph: fax:	0350 329 375 0350 332 693
Stewart Learmonth	Horticultural Research Centre Manjimup, WA	ph: fax:	097 712 444 097 712 380
Pam Strange	Scholefield Robinson Hort. Services Kingswood, SA	ph: fax:	08 8373 2488 08 8373 2442

The meeting opened with an outline of the existing IPM strategy as developed by Dr Paul Horne over many years. He described the key insect species, both pest and beneficial, that were monitored weekly and what happened when insecticides were used. This included results from the most recent season in Victoria, and along the Murray in northern Victoria/ southern NSW. Keith Lewis then gave a similar explanation of the approach being taken to IPM in potatoes on the Atherton Tableland, Qld.

These two outlines explained that IPM was working in vastly different parts of Australia, and that different numbers of pests were tolerated. It was also clear that although several important pests were common to the two areas, there were different pests of concern in each area.

John Hall gave a talk describing how IPM had developed in tomatoes, and then potatoes around Bundaberg in Queensland. He explained how grower practices had changed from intensive, regular use of insecticide sprays to using IPM in a relatively short period of time. This change involved a significant change in grower attitudes to pest numbers and also in recognising that beneficial insects existed in their crops.

As a group, the meeting then went through the exercise of listing major and minor pests in their respective districts. In the absence of Stewart Learmonth, Paul Horne nominated some pests (whitefringed weevil and African black beetle in particular) of concern in WA.

The results of this discussion are presented in Table 1. The most obvious outcome was that almost all pest species were classified as major pests in some districts and only minor pests in others. Only two species (crickets and green vegetable bug) were considered minor pests and not major pests. Two species, the Green Mirid and the Smudge Bug were thought to be minor pests in some circumstances but beneficial (predators) in others.

After listing and classifying the pests of potatoes, the meeting discussed what they saw as the control options available now, or could be available in the near future. The intention here was to identify the best possible combination of compatible control measures. Control options are listed as either biological, cultural or insecticides. **These are summarised in Table 1, and the information in this table contains the basis for IPM in potatoes.** It should be noted that some of the sprayable biological controls (pathogens) are also listed in the insecticide list. We identified a range of beneficial insects that scouts were already using in their assessment of crops.

One important discussion was on the availability of insecticides for use in IPM systems. When insecticides are still required, what is the best available option? The best available guide is in The Good Bug Book (Australasian Biological Control Inc. and DPI Qld, 1995). We tried to list the best options for specific pests in potatoes, but it was noted that some of the best options are not specifically registered on potato crops (Larvin and BT) and other pathogen sprays are still being tested (eg. GemStar).

Insecticides are the main control option considered by many growers and many advisors. This meeting was able to produce a list of choices to consider when particular combinations of pest and beneficials exist. Reference to Table 1 should help both growers and advisors to know what to look for and that resorting to "hard" insecticides is not always the best choice. Instead, a range of biological, cultural and "soft" chemicals may be available. If not, improved use of timing of sprays, or targetting of sprays (such as border spraying) are listed. District validation and improvement of IPM is very important.

Most at the meeting were able to give examples of beneficial species, cultural controls and softer insecticides to use in their district. The wasp, *Orgilus lepidus*, is now being reared for commercial releases, and so augmentative releases of this species are now possible. Release methods were described by Cindy Edward, and trial data showing the effectiveness of Orgilus in Victorian trials.

The meeting discussed what might be the best way of providing supporting information on beneficial insects in potatoes to growers and advisors. The options favoured were a poster and a more detailed guidebook. A proposal on production of such a guidebook was (and is still) being considered by HRDC.

The main value of this meeting was to provide examples from different districts that IPM was already working, and could be made to work in more districts with the expertise of people at the meeting. It was emphasised several times that the first-hand contact between crop-scout and farmer was the best means of ensuring adoption of the correct information on IPM.

Sampling protocols were described by Paul Horne and Keith Lewis, and were discussed at the meeting. Sampling protocols were provided and a draft general protocol is included here. Regular (weekly) crop inspections are necessary and a combination of trapping and leaf-checking is recommended. Pheromone traps for potato moth, leaf-counting for other species of caterpillars, moth eggs, aphids and thrips, and also beneficial species. Supplementary sampling with sweep nets is recommended when the scout needs to confirm that significant numbers of parasites and or predators are present.

Table 1 Control Options for Pests of Potatoes

Pests	Biol Control	Cultural Control	Insecticides Best available
Major (M) Minor (2)			
Potato moth (M,2)	Wasps Damsel bugs	Irrigation Hilling Weed control	[Larvin] [BT]
Aphids (M,2)	Wasps Predators [Verticillium]	Roguing Seed source	Pirimor "Chess" [Verticillium]
Heliothis (M,2)	Wasps Tachinids (Trichogramma) Smudge bug Shield bugs Lacewings BT		NPV BT
Spodoptera (M,2)	Wasps (Trichogramma) Smudge bug Shield bugs Lacewings BT		BT
Loopers (M,2)	Wasps Damsel bugs Spiders BT		BT
Wingless Grasshoppers (M,2)	[Metarhizium]		Border spray Bait [Metarhizium]
Crickets (2)	[Metarhizium]		Border spray Bait [Metarhizium]
Leafhoppers (M,2)	Predatory bugs Lacewings		
Green Vegetable bug (2)	Parasites		
Rutherglen bugs (M,2)		Furrow	?Threshold Detergent
Thrips	Predatory bugs	Seed source Weed control	Pre-plant granule Border spray Threshold

Appendix 2:

SAMPLING PROTOCOL FOR MONITORING POTATO PESTS

Protocol for sampling potato crops: As developed at the May 1997 meeting

1. Pests

Looking at 100 leaves is the basis for the main monitoring. We recommend looking at 2 leaves, one lower leaf one upper leaf, on each of 50 plants. Look at true leaves, not just leaflets.

Green peach aphids are found on the underside of the lower leaves, so if you look at 50 plants, you have inspected 50 leaves, even if you do look at 2 leaves per plant. Therefore, for green peach aphids, make sure you record the number of aphids on lower leaves. Record the numbers of wingless rather than winged aphids.

Thrips may be mature (with wings) or immature (no wings). Plague thrips do not vector spotted wilt, but onion thrips do, so it is good to know what species is present. For help with identification contact State Departments, or IPM Technologies.

You can also monitor for thrips using yellow sticky traps. These traps will catch many insects in addition to thrips, and are good to see what is flying in the crop. We attach them to a bamboo cane and tape them at the top and bottom.

Potato moth are easily monitored using pheromone traps. Count the number in a trap each week. However, leaf mines can also be counted.

Heliothis can be monitored by pheromone traps, but a more accepted monitoring method is to count eggs, small, medium and large caterpillars.

Spodoptera are monitored as for Heliothis, distinguishing between eggs, and the different larval stages.

Loopers are counted and simply count the total, not separate stages.

Moth eggs, belonging to loopers or heliothis, are often found, but they do not always cause damage. It is useful to know what caterpillars are going to develop from these eggs before predicting damage or spraying.

Other insects, including grasshoppers, green or brown leafhoppers, mirid bugs and Rutherglen bugs are often found. Watch for invasions from a particular edge, rather than a general increase throughout the paddock.

2. BENEFICIALS

In addition to knowing what pests are present, it is important to know what beneficial species are in the crop. Some of the more active species will be found on yellow sticky traps more than in the leaf-count.

We try to record the number of each beneficial species in 100 leaves, and also presence/absence on the sticky traps. It is important to count aphid mummies.

When you need to be sure that good numbers of certain beneficial insects are present, then supplement the leaf count with sweep net samples.

Key species are

Parasitic wasps

- *Orgilus lepidus*
- *Apanteles subandinus*
- Micro-Hymenoptera (including aphid parasites)

Damsel bugs

Shield bugs

Mirids

Green lacewings (adults and larvae)

Brown lacewings

Ladybird beetles

- Transverse ladybird

Common spotted ladybird

two spotted ladybird

Red and blue beetles

Hoverflies

(presence/absence of adults)

no's of larvae

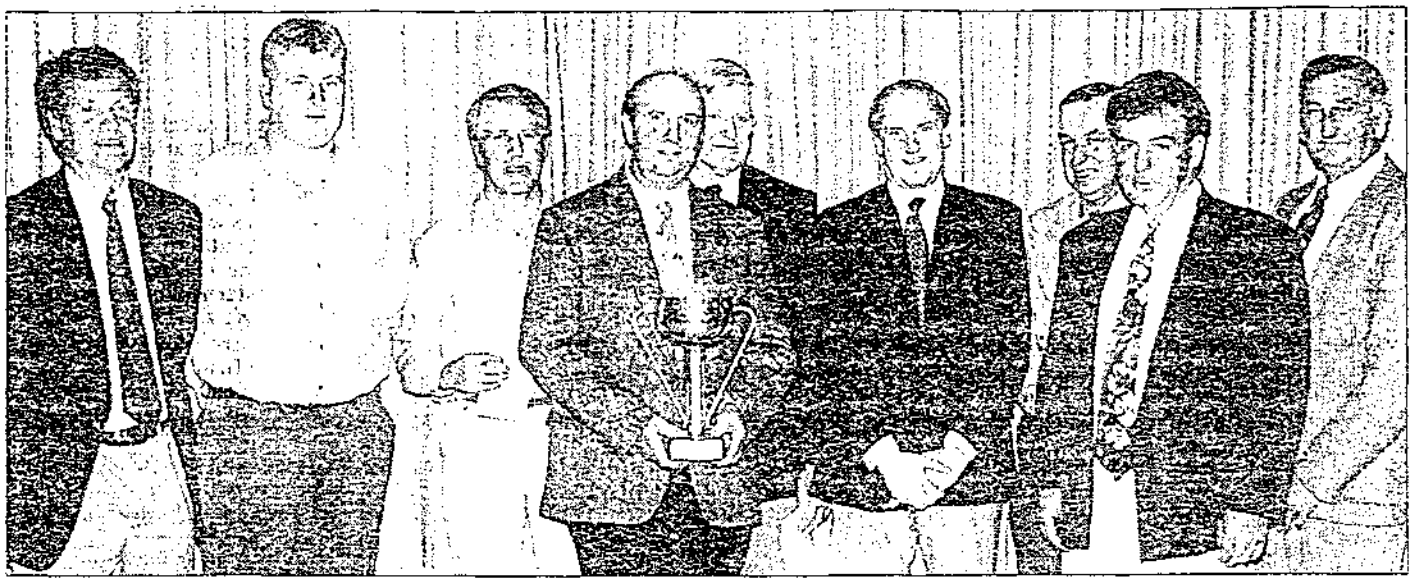
Spiders

Monitoring Record 1997-98
Potato Crops

Farmer: Site:
Phone

Date	Aphids/100	PTM	Thrips	Moth Eggs	Leafhoppers	Mirids	Loopers	Rutherglen Bugs	Other		

Beneficials		Farmer				Site					
Date	Lacewings	Wasps	Hoverflies	Nabiids	Ladybirds	Spiders	Pentatomids	Red&Blue beetles			



GROWERS: *Top performing potato suppliers. Left to right are: Tony Toohey of Mollongghip; Justin Clarke, Waubra; Ian Slater, Clarke's Hill; winner of the most successful grower's holiday package worth $3,500 and perpetual trophy, Barry Scobie from Dean; Bob Allen, Newlyn; presenter of the awards, Chief Executive Officer McCain Foods (Aust) Pty Ltd, Basil Hargrove; Frank Stephens, Mt Prospect; Tom Russell, Alvie; and John Jolliffe of Newlyn.*

Dean's Barry Scobie wins prestigious McCain's award

Dean potato farmer, Barry Scobie of J. L. Scobie and Sons, won the honour of being the top performing potato supplier to the McCain Foods (Aust) Pty Ltd Ballarat plant for the 1996 97 season.

A trophy cup and a holiday package to the value of $3,500 was awarded to Mr Scobie by Chief Executive Officer of McCain Foods, Mr Basil Hargrove, at the company's annual dinner held at the Balanada Room, Mercure Inn earlier this month.

Approximately 220 guests from the Central Highlands, Colac, Warnambool and Riverina areas gathered to enjoy a three course meal and to learn of this season's successful growers. Seven Central Highland's growers each received a cash award of $500 for being amongst the top eight performing growers for the year, and the most successful grower outside the Central Highlands, Tom Russell of Tom Russell Market Gardeners of Alvie via Colac, received a cheque for $1,000. Successful growers were selected by means of a point score system which takes into account various quality factors for potatoes delivered over the entire season.

The seven growers who were presented the $500 awards were: R.L., L.M. & J.R. Allen of Newlyn; Glazebrook Farming Co. of Waubra; P.J. & W.J. Harrison of Waubra; S & G Slater & Sons of Clarkes Hill; E. & A. Stephens & Sons of Mt Prospect; A. J. Toohey of Mollongghip and Tremaine Estates Pty Ltd of Newlyn.

IPM: WHERE IS IT AT?

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IPM AT PRESENT

An Integrated Pest Management (IPM) approach for dealing with pests of potatoes can work extremely well for growers in all sectors of the potato industry, including crisping potato growers. We have shown this in trials in Victoria, South Australia, NSW (Murry River districts) and Queensland. However, there are some important points to remember or pest problems could be severe. These are described here.

WHAT MORE IS REQUIRED?

Firstly, there are different perceptions of what IPM involves. Successful use of IPM depends on knowing exactly what IPM means.

IPM is (i) NOT simply stopping using insecticides,
(ii) NOT relying just on biological control alone
(iii) NOT just using one or two insecticide sprays.

IPM (iv) DOES involve using biological and cultural controls, backed up by insecticides,
(v) DOES involve regular (weekly) monitoring of each crop
and (vi) MAY involve releasing biological control agents (wasps).

IPM relies on decision-making based on up to the minute information from each crop. The information and the way it is used can lead in many cases to little or no insecticide use, but it is not a universal rule. Detailed sampling by crop scouts will provide the information each week to decide what sprays, if any, are required.

Crop scouts try to collect information to answer many questions at once, including how many pests are present, but also, how many predators and parasites are present, what is the degree of cultural control, what stage of pest (adult, egg or juvenile) is present , what was the seed source, and have insecticides been used before. The answers to these questions allow the risk of damage by insects to be assessed.

This approach was tested out this year in Victoria during the longest dryest summer on record in many districts. Despite the weather conditions, most crisping growers taking part in the demonstration were happy to find that they could produce the crop they wanted without insecticides and without losing quality and yield due to insect pests.

INSECTICIDES

The most difficult aspect of IPM for some growers to appreciate is that insecticides can make pest problems worse. It depends on the frequency of spraying, the type of chemical, the

temperature, the crop stage and application method, but it certainly happens frequently. Green peach aphids and potato moth can both become more abundant and damaging after inappropriate sprays. The increase in pest numbers occurs when the predators and parasites are killed but pests are still present. Then a resurgence of pests has nothing to hold it back.

Insecticides may well be used in an IPM approach, but the timing and type of insecticide are selected carefully. The most broad-spectrum and powerful killer is not always the best! Instead, a softer chemical could be used as a foliar spray or preplant systemics may be better for early control of sucking pests. Similarly, border sprays may be more appropriate than spraying entire fields.

MORE REFINEMENTS

The most important of many factors that make IPM work are as follows; use clean seed, monitor for pests and beneficials, release Orgilus wasps, maintain soil cover. However, information on other pests or local factors could significantly improve IPM in any given district. I have listed what I believe are some of the most important issues to look at.

Thresholds

What needs to be worked out (in each district) to make IPM precise, are the thresholds for spraying pests such as aphids, thrips, Rutherglen bugs, loopers etc. The thresholds are simply how many of these pests can be tolerated in the crop before spraying is necessary. (The answer is not "none"!)

Aphids and thrips that carry in diseases such as leaf-roll or tomato spotted wilt virus are key species for which thresholds should be developed in susceptible districts. Not all aphids and thrips that are found in potato crops carry diseases, and so identification is important in the monitoring routine.

Compatible insecticides

What are the safest insecticides to use, and are they available for potatoes? We have some information but not a full set of data.

Other major pests

Control of African black beetle in WA is an important impediment to adopting IPM in some, but not all, districts in that state. Timing and frequency of spraying with conventional chemicals for black beetle will determine whether this IPM strategy will be workable in some WA districts.

This research work has been funded by HRDC and the potato levy. I thank all the potato growers over several years who helped us with trials, but mostly those growers who trusted us in the last hot dry season. They have shown all growers that IPM works.